Remarks

The Office Action mailed May 15, 2008 has been carefully considered together with each of the references cited therein. The amendments and remarks presented herein are believed to be fully responsive to the Office Action. Accordingly, reconsideration of the present Application in view of the following remarks is respectfully requested.

Applicant has amended the claims to more clearly recite what Applicant believes to be the invention. Claims 1 and 19 were amended to recite that the fuel oil having improved filterability consists of a mineral oil middle distillate or a mixture of mineral oil middle distillate and a mixture of fatty acid alkyl esters and an additive consisting of a copolymer of ethylene and vinyl esters, and that the copolymer consists of comonomers. Claims 1, 19 and 31 were further amended to optionally incorporate the elements of claims 5 and claims 14-17. Support for this amendment may be found in originally filed claims 1, 5, 14-17 and 19 and in paragraphs [0002] and [00031] and [00032] and [00046] of Applicant's Specification. Claims 5, 13, and 23 were canceled. Claims 14-17 were amended to refer to the additive now recited in amended claim 1. Support for the amendments to claims 1, 19, 14-17 may be found in Applicant's originally filed claims and in paragraphs [0002] of Applicant's Specification. It is believed that no new matter has been introduced by these amendments.

Applicant's invention is directed to providing additives and methods for improving the cold flow properties of middle distillates of mineral oil origin and mixtures of mineral oil middle distillates and mixtures of fatty acid alkyl esters, such fuel oil mixtures known as biofuels, which have a low sulfur content **and** a low aromatics content, when the blending of the additive and the oil take place at low blending temperatures. Applicant surprisingly discovered that the additives which achieved the objectives of the invention comprised a copolymer of ethylene, actually a terpolymer, and comonomers of Applicant's formula (b) having tertiary-branched vinyl esters, and comonomers of formula (c) such as vinyl acetate with the specified contents of comonomers (b) and (c). Tables 3 – 6 of Applicant's Specification show

the effectiveness of the additives of the present invention in terms of improved filterability (Table 3) and improved Cold Filter Plugging Point (CFPP) response (Tables 4-6) in mineral oil Test Oils 1, 2 and 3. Additives not having Applicant's comonomer b) with a tertiary branched radical failed to achieve this effectiveness. In Table 3, when Applicant's comonomer b) included a tertiary-branched radical, the filterability results shown for the additives P1 through P10 of the invention as claimed showed significantly lower filterability times than the comparative examples 12-16 in Test Oil 1. In Table 5, when the comonomer included the tertiary-branched radical as in the compounds P1 through P10, the cold filter plugging point, CFPP, showed significantly lower values, for example at 1000 ppm, than the same dose in Test Oil 2 for the comparative compounds of P13-P16 or P11 wherein these compounds did not have a comonomer b) with a tertiary-branched radical.

Claims 1-14, 16-17, and 19-30 were rejected under 35 U.S.C. 103(a) as being unpatentable over Brown (US Patent No. 5,906,663) in view of Murakami (US Patent No. 5,730,762). The rejection of claim 1 as amended under 35 U.S.C. 103(a) as being unpatentable over Brown (US Patent No. 5,906,663) in view of Murakami (US Patent No. 5,730,762) should be withdrawn for the reason that Brown teaches away from Applicant's invention, or is at best silent on any fuel oil which has the limitations of Applicant's fuel oil, and no one skilled in the art would be able to combine the Murakami reference with the Brown patent to arrive at Applicant's invention, and for the reason that **Applicant unexpectedly discovered that the presence of Brown's additive having Brown's required component B consistently fails filterability tests in the low sulfur, low aromatic fuel oils as claimed by the Applicant. Brown's B component is excluded from Applicant's invention as claimed in amended claim 1.** Brown differs from Applicant's claimed invention in that there is no teaching of the fuel sulfur content of at most 350 ppm, an aromatics content of at most 22%, a density of less than 0.84, a 90-20% boiling range of less than 110°C, a paraffin content of more than 3%-by weight. The disclosure of Brown differs further from Applicant's invention by requiring an additive which consists of **both an A) component (Column 2, line 50 to Column 4, line 9) and a B)**

component (See column 4, lines 10-28) as recited in Brown's claim 1. Brown discloses a way of meeting the problem of CFPP regression, deterioration in CFPP performance over time, by the use of a specific co-additive comprising components (A) and (B). Applicant's invention relates to a copolymer or terpolymer comprising a subset of Brown's broad definition of component A, but without Brown's co-additive component B. As discussed hereinabove, Applicant's copolymer can be employed at cold blending conditions and surprisingly leaves the filterability of Applicant's specific low sulfur mineral oil middle distillate, or a biofuel oil, which is a combination of the mineral oil middle distillate and a mixture of fatty acid alkyl esters, unchanged, and provides further improvement of the Cold Filter Plugging Point of the mineral oil middle distillate or biofuel oil mixture. Thereby, Applicant's fuel oil has an improved filterability over the prior art. Omission of an element with retention of its function is an indicia of unobviousness. No one skilled in the art would be able to arrive at Applicant's invention for improving mineral oil middle distillate fuel oil or a biofuel oil without undo experimentation. In a previously submitted Declaration under 1.132, filed by Matthias Krull, submitted on 12 February 2008, Dr. Krull presented data which clearly showed the unexpected filterability advantages of the present invention over the Brown reference in a side-by-side analysis for both mineral oil middle distillate and biofuel oils wherein the biofuels are middle distillate fuel oil mixtures having mineral oil middle distillate and from 5 to 25 % wt of a mixture of fatty acid alkyl esters. For comparison of the additive mixtures of Brown (US Patent No. 5,906,663), herein after referred to as the Brown Patent, with terpolymers according to the invention, the following CFPP and filterability tests in a low sulfur, low aromatics fuel oil (Test oil 5) were prepared. The characterization of the test fuel oil was made according to the methods described in the subject application.

		Test oil 5
Distillation		
IBP	[°C]	176
20 %	[°C]	235
90 %	[°C]	328
FBP	[°C]	348
Cloud Point	[°C]	-9,9
CFPP [°C]		-11
Paraffin 10°C below CP (DSC)		3,7 %
Density@15°C	[g/cm³]	0.834
Sulfur content	[ppm]	9
Aromatic content	[% by weight]	17,6
of which mono	[% by weight]	16,7
di	[% by weight]	0,9
poly	[% by weight]	<0,1

In this Test oil, additives P1, P6 and P8 as characterized in Table 1 of the subject application (containing 65% active in kerosene) were compared with the additive combination as exemplified in the Brown Patent. In the Brown Patent, terpolymer A is said to be Dodiflow-V-4159, which was sold commercially by Hoechst AG. Clariant, as the legal successor of Hoechst AG in this technical field, is in the position to say that this Dodiflow-V-4159 contained approximately 16 mol-% vinyl acetate and approximately 1.2 mol-% vinyl ester of neodecanoic acid. A similar product was already cited as Comparative Example P14 in the subject application. It was shown that this additive has only borderline solubility in fuels with low sulfur and low aromatics, thus, poor filterability. Here Dodiflow-V-4159 was used as comparative additive P"A".

The Brown Patent discloses that in addition to the "A" component, an additive component B which is an ethylene-vinyl acetate copolymer with an ester content at least 2 molar per cent lower than that of the esters in "A" is required. For comparison purposes in the following examples a component P"B" which was a very similar material to component B of the Brown Patent was used, which was an ethylene-vinyl

acetate polymer with a number average molecular weight of 5200 (GPC) and a vinyl acetate content of 13.7 wt.-% (equivalent to 4.9 mol-%) copolymer (P"B").

CFPP effectiveness in Test oil 5

Example No.	Additive	300 ppm	500 ppm	700 ppm
62	P1	-18 °C	-20 °C	-22 °C
63	P6	-19 °C	-21 °C	-24 °C
64	P8	-19 °C	-22 °C	-25 °C
65 (comp.)	P"A" + 2% P"B"	-16 °C	-18 °C	-19 °C
66 (comp.)	P"A" + 5% P"B"	-18 °C	-20 °C	-21 °C

To test the solubility of the copolymers (terpolymers) according to the invention in comparison to the additive mixtures of the Brown Patent, 500 ml of Test oil 5 were admixed at 25°C with 500 ppm of the additive, respectively to provide an additized oil sample. All of the additive mixtures to be tested were admixed at 25 C, and all additives were a 65% active concentration in kerosene. The solubility test was performed according to the description in the subject application. The results of the solubility determination are shown in the following table which presents data representing the filterability of the Test Oil/Additive mixture. Filterability is determined by the time required to filter the additized test oil sample. Filter times in excess of 120 seconds are considered unacceptable.

Filterability of Additized Test Oil 5

Example No.	Additive	oil temperature	Time [sec]	Volume [ml]
67 (comp.)	none	25 °C	55	500
68	P1	25 °C	63	500
69	P6	25 °C	59	500
70	P8	25 °C	60	500
71 (comp.)	P14 + 2% P"B"	25 °C	>120	approx. 450
72 (comp.)	P14 + 5% P"B"	25 °C	>120	approx. 300

These experiments clearly show that the copolymers of the invention containing structural units derived from vinyl acetate and units derived from a vinyl ester of a

tertiary branched carboxylic acid in the specified molar ranges have excellent solubility in middle distillates having low sulfur and aromatics content, even at low blending temperatures. In contrast to the additives of the subject invention, the additive combinations of the Brown Patent resulted in filter blockages (i.e., they have unacceptable filtration times >120 sec). Especially at higher contents of component B, which are necessary for an improved CFPP performance, the additive combinations of the Brown Patent are not fully soluble under cold blending conditions. The lack of solubility at cold blending conditions potentially will result in undesired filter blockages. Furthermore, the copolymers, or terpolymers of the subject invention show an improved CFPP performance over Brown. The terpolymers of the instant invention provide an economic advantage in the adjustment to the CFPP of the fuel oils with lower dosage rates than are required by the additive mixtures of Brown for the same fuel oil.

The copolymers of the invention are equally suitable for improving the cold flow properties of biofuel oils, or mixtures of fatty acid methyl esters with mineral oil middle distillate fuel. This is shown by CFPP measurements in Test oil 5 (characterization shown hereinabove) also containing varying amounts of rape seed methyl ester. The rape seed methyl ester used comprised about 62.2% oleic acid methyl ester, 19.7 % linolic acid methyl ester, 8.9% linoleic acid methyl ester, 4.6 % palmitic acid methyl ester and 1.5 % stearic acid methyl ester as the main components. The following table shows the impact of additives of the instant invention on the Cold Filter Plugging Point (CFPP) of biodiesel mixtures based on 85 % of Test oil 5 and varying amounts (5, 15, and 25 %) of rape seed methyl ester.

CFPP Effectiveness in mixtures of Test oil 5 with Varying Amounts of Rape Seed Methyl Ester (RME)

Example no.	test oil 5	RME	additive	200 ppm	400 ppm	700 ppm
73	85 %	15 %	P1	-16 °C	-19 °C	-21 °C
74	85 %	15 %	P6	-15 °C	-20 °C	-23 °C
75	85 %	15 %	P8	-17 °C	-20 °C	-22 °C
76	95 %	5 %	P6	-17 °C	-21 °C	-24 °C
77	75 %	25 %	P6	-14 °C	-17 °C	-21 °C

Usually the addition of fatty acid methyl esters improves the solubility characteristics of mineral diesel blends towards cold flow additives. However, in mixtures of mineral diesel fuel with fatty acid methyl esters, the additive mixtures of Brown especially upon cold blending conditions resulted in fuels having poor filterability. In contrast, the terpolymers of the instant application under the same blending conditions give fuels of superior filterability for fuels having from 5 to 25 % fatty acid methyl esters as shown below (test conditions equal to those described above).

Filterability of additized mixtures of test oil 5 with Varying Amounts of Rape Seed Methyl Ester (RME)

Example No.	test oil 5	RME	Additive	Oil temperature	Time [sec]	Volume [ml]
78 (comp.)	85 %	15 %	none	25 °C	48	500
79	85 %	15 %	P1	25 °C	56	500
80	85 %	15 %	P6	25 °C	50	500
81	85 %	15 %	P8	25 °C	51	500
82 (comp.)	85 %	15 %	P14 + 2% P"B"	25 °C	>120	approx. 470
83 (comp.)	85 %	15 %	P14 + 5% P"B"	25 °C	>120	approx. 340
84	95 %	5 %	P6	25 °C	55	500
85	75 %	25 %	P6	25 °C	47	500
86 (comp.)	75 %	25 %	P14 + 5% P"B"	25 °C	>120	approx. 380

Thus, **by requiring component B of Brown**, as shown herein above for mineral oil middle distillate fuel oils as claimed by Applicant, and equally for mineral oil fuel oil mixtures with from 5 to 25 wt-% fatty acid alkyl esters, **the Brown Patent teaches away from Applicant's invention**, and no one skilled in the art would arrive at Applicant's invention armed only with the disclosure of the Brown patent.

As previously stated, the Murakami Patent discloses a gas oil obtained by subjecting paraffin containing crude oil to atmospheric distillation and hydrogenation. The examiner alleges that the claimed percentage of paraffins as Murakami exemplifies wherein the sulfur content is less than 350 ppm and the aromatics

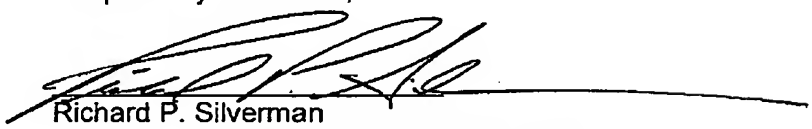
content is less than 22 suggests the combination of the Brown and the Murakami reference to provide Applicant's claimed very low sulfur fuel properties to Brown. However, as shown herein above by way of the failed filterability tests for mineral oil middle distillate fuels, Brown teaches away from Applicant's invention. No combination of Brown and Murakami would provide anyone skilled in the art to arrive at Applicant's fuel oil having Applicant's copolymer. Furthermore, Murakami is silent on any additive being a copolymer as claimed by Applicant. In addition, Murakami is silent on any fuel oil having from 5 to 25 % by weight of a mixture of fatty acid alkyl esters, and in fact Murakami (See column 1, lines 21 to 38) specifically teaches away from any combination of mineral oil and a fatty acid ester (See Column 1, line 32) which Murakami equates with anti-wearing agents (See column 1 lines 35-38). Therefore, the rejection of claim 1 as amended under 35 U.S.C. 103(a) as being unpatentable over Brown (US Patent No. 5,906,663) in view of Murakami (US Patent No. 5,730,762) should be withdrawn for the reason that Brown teaches away from Applicant's invention, or is at best silent on any fuel oil which has the limitations of Applicant's fuel oil, and no one skilled in the art would be able to combine the Murakami reference, which does not disclose Applicant's copolymer, with the Brown patent to arrive at Applicant's invention of a low sulfur, low aromatic fuel oil having improved filterability, and for the reason that Applicant unexpectedly discovered that the presence of Brown's additive having Brown's required component B consistently fails filterability tests in low sulfur, low aromatic fuel oils as claimed by the Applicant.

The rejection of claims 2-14, 16-17, 19-30 as amended under 35 U.S.C. 103(a) as being unpatentable over Brown (US Patent No. 5,906,663) in view of Murakami (US Patent No. 5,730,762) should be withdrawn for the reasons given in support of claim 1 from which they depend. Claim 19 recites a method for improving the cold flow behavior of a fuel oil having the properties recited in amended claim 1 and should be allowable for the reasons given in support of amended claim 1. Claims 20-30 depend from amended claim 19 and should be allowable for the reasons given in support of claim 1 and 19.

Claims 31-34 were rejected under 35 U.S.C. 103(a) as being unpatentable over Brown (US Patent No. 5,906,663) in view of Murakami (US Patent No. 5,730,762) and Erner (US 4,364,743). The rejection of claim 31 as amended under 35 U.S.C. 103(a) as being unpatentable over Brown (US Patent No. 5,906,663) in view of Murakami (US Patent No. 5,730,762) and Erner (US 4,364,743) recites a fuel oil comprising a proportion of mineral oil middle distillate and from 5 to 25 % by weight of a mixture of fatty acid alkyl esters. Claim 31 should be allowable over Brown for the reasons given hereinabove and Applicant's showing that for fuel oils comprising mineral oil middle distillate and from 5 to 25 wt-% fatty acid methyl ester, the addition of the required Brown component B resulted in failed filterability tests, and for the reason that Murakami teaches away from any fuel oil having a fatty acid ester. Murakami reference teaches away from the presence of any anti-wear agents (column 1, lines 21 to 38) which anyone skilled in the art would recognize as fatty acid esters. Murakami points to problems associated with high price and **poor storage stability which equates to poor filterability**. New claims 32-34 depend from new claim 31 and should be allowable for the reasons discussed hereinabove in connection with claim 1 and claim 31 which provide fuel oils with improved filterability.

It is respectfully submitted that, in view of the above remarks, the rejections under 35 U.S.C. §103 should be withdrawn and that this application is in a condition for an allowance of all pending claims. Accordingly, favorable reconsideration and an allowance of all pending claims are courteously solicited.

Respectfully submitted,



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